DECEMBER 1966

AGRICULTURAL Research

U.S. DEPARTMENT OF AGRICULTURE

CARBOHYDRATES IN DIET—Pages 8 & 9

AGRICULTURAL
Research
December 1966/Vol. 15, No. 6

For Better Nutrition

We're among the best-fed people in the world, and we're eating better now than ever before. Yet much remains to be learned about human nutrition.

ARS research is adding to this basic knowledge. At the same time, research is making it possible for homemakers to make better use of the foods we now eat.

Scientists, for instance, recently tested methods of cooking fresh and frozen turkeys. As a result, homemakers can save time and work and guard against spoilage in preparing and cooking their holiday birds (p. 11).

Nutrition researchers also compared dishes made with fresh and with processed potatoes for time and cost of preparation, palatability, and nutritive value. Their conclusion: If a homemaker values her time at 50 cents an hour or more, she'll be money ahead using processed potatoes for three out of four recipes (AGR. RES., October 1966, p. 5).

Basic to a better understanding of human nutrition is a current ARS study of the role of carbohydrates in the diet. Their importance is emphasized by a major shift in our eating habits during the past half-century. The average American, who got 62 percent of his carbohydrates as starches and 22 percent as sugars 50 years ago, now gets 42 percent as starches and 36 percent as sugars.

Scientists formerly considered all carbohydrates to be similar in nutritional value. Now they know that different carbohydrates produce different effects in the body—depending on the heredity of the eater and the other foods in his diet.

To pin down the physiological effects of this shift, researchers studied the body reactions of college students who ate alternate diets high in starch and high in sugar (p. 8).

Woman volunteers on high-sugar diets had less fatty acid in their blood serum than those on high-starch diets. Data on men volunteers are now being analyzed. Results with the women may indicate that, with a high-sugar diet, more fat is deposited in the body cells.

More remains to be learned about carbohydrates—so far, no dietary recommendations can be made as a result of the ARS study. But this and other research will lead to diets that better meet our nutritional needs.

AGRICULTURAL RESEARCH is published monthly by the Agricultural Research Service, United States Department of Agriculture, Washington, D.C. 20250. Printing has been approved by the Bureau of the Budget, August 15, 1958. Yearly subscription rate is $1.50 in the United States and countries of the Postal Union, $2 in other countries. Single copies are 15 cents each. Subscription orders should be sent to Superintendent of Documents, Government Printing Office, Washington, D.C. 20402.

Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

Toward Increased Understanding of Virus Diseases . . .

THIRD FOOT-AND-MOUTH DISEASE ANTIGEN FOUND

In agar gel plate test, center well contains foot-and-mouth disease (FMD) virus. Lines around center indicate antibodies produced in response to antigens in virus. Note third reaction line (arrow) indicating virus infection-associated (VIA) antigen in blood serum from infected guinea pig. Other wells contain blood serum from cattle vaccinated against FMD with inactivated virus. Numbers show days since vaccination. Since there is no infection present, VIA antigen is not present and there is no third reaction line even 9 months after vaccination. (Photo No. PN–1448)

ARS SCIENTISTS have found a previously undetected antigen, apparently associated with infections of foot-and-mouth disease (FMD) but not part of the virus that causes this disease of cloven-hoofed animals.

Immunologist K. M. Cowan and veterinarian J. H. Graves at the Plum Island Animal Disease Laboratory, Greenport, N.Y., are now trying to learn what part the newly discovered antigen plays in FMD infections.

To scientists doing basic research on the multiplication of viruses, (AGR. RES., June 1965, p. 3 and May 1966, p. 6), this knowledge may provide new clues to how virus infections take place and how viruses are able to duplicate themselves.

An antigen is a substance which stimulates the production of antibody when introduced into an animal. Previously, scientists had known of two FMD antigens—the disease virus itself and the virus' protein subunits. Since the third antigen is not part of the virus but appears to be produced as a result of infection, Cowan and Graves call it "virus infection-associated" (VIA) antigen.

The two previously known antigens are type-specific—each reacts only to antibodies produced in response to a specific type or subtype of FMD virus. The VIA antigen, by contrast, is not type-specific and will react to antibodies produced in response to one or more types or subtypes of FMD virus.

Thus, the scientists reason, the VIA antigen may have caused typing difficulties in the past. In countries where

FMD outbreaks occur, it's important to know the type or subtype of FMD virus present in order to control it. Immunity to one type of FMD virus does not protect an animal from infection with another type or subtype. Discovery of the new antigen, the scientists believe, should help diagnosticians determine which type or subtype is causing a FMD outbreak.

The VIA antigen could also be used to test vaccinated animals to make sure that FMD viruses in the vaccines are inactive. Animals will produce VIA antibodies only in response to infection, and infection is possible only if active viruses are present.

Previously, scientists working with crude preparations of FMD virus had detected two precipitin (antibody) reaction lines on agar gel, indicating the presence of two antigens.

In their agar gel tests, Cowan and Graves detected and photographed three reaction lines with FMD virus in blood serum from an infected guinea pig on an agar gel plate. indicating the presence of three antigens. To back up their conclusions, they infected cattle and guinea pigs with FMD virus and found that these animals produced VIA antibody before they produced antibody for the virus components.

They also found that animals immunized with inactivated FMD virus did not develop antibodies to VIA antigen.

Cowan and Graves believe they were able to detect the VIA antigen in agar gel plate tests because they were working with highly purified preparations of FMD virus, produced as part of the Plum Island research program.

In addition, their ability to detect this antigen was increased when they eliminated thimerosal from their agar plates. Thimerosal is a germicide usually incorporated into agar gel to prevent the growth of contaminating micro-organisms. This germicide causes the degradation of VIA antigen and either eliminates or markedly decreases the formation of the third precipitin line.

While Cowan and Graves are not yet certain what VIA antigen is, they speculate that it may be an enzyme involved in virus replication. They suggest this because the VIA antigen is not a part of the virus and is detected in tissue cultures infected with FMD virus before the other two antigens are detected.■

Electron Microscope Photographs . . .

FOOT-AND-MOUTH VIRUS MULTIPLICATION

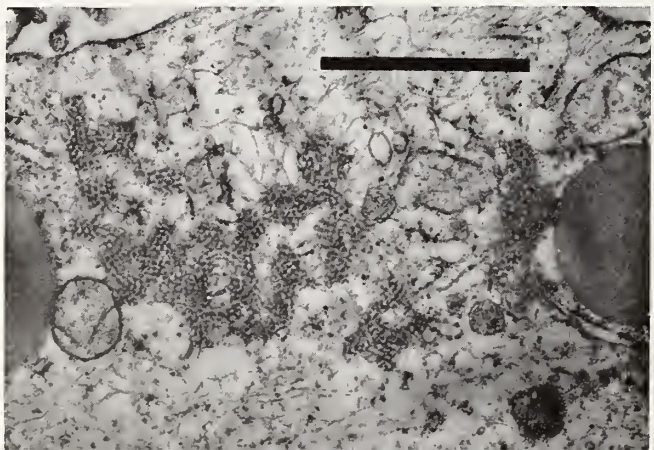
For the first time, scientists have photographed by electron microscope particles of the foot-and-mouth disease (FMD) virus in infected animal cells.

These photographs, showing crystal-like arrays of virus particles under formation, are a significant advance toward better understanding how the FMD virus multiplies in living animal cells.

The virus formations photographed by ARS microbiologist S. S. Breese, Jr., and veterinarian J. H. Graves were similar to those of polio virus photographed by other scientists. Breese and Graves are studying the stages of FMD virus development at the Plum Island Animal Disease Laboratory, Greenport, N.Y., in continuing research to improve our methods of keeping the disease out of the country and of combating it should it invade our livestock industry. The Plum Island scientists will now observe changes in cell structure caused by virus multiplication.

In trying to photograph the virus particles, Breese and Graves found that virus multiplication could be seen only when vigorous, young cultures of pig kidney cells were used as host tissue. Previous experiments with calf or hamster kidney cells were inconclusive because the virus caused extensive cell damage.

Infection by FMD virus is rapid. The virus can be detected in cells between 100 and 110 minutes after live virus is inoculated into cell cultures. Within 150 minutes after infection, the virus can be detected outside the cells.■



Particles of foot-and-mouth disease virus are seen in pig kidney tissue under electron microscope. Black line on photo (upper right) equals 0.004 inch. (Photo No. PN–1449)

Toward Avian Leukosis Control . . .

SANITATION

Can Help Prevent Spread of Marek's Disease

MAREK'S DISEASE, an acute form of avian leukosis that causes more poultry losses than any other disease, can spread from infected to healthy chickens through saliva and droppings, ARS research shows.

The results imply that farmers can control the disease to some extent by rigidly following sanitary procedures to reduce the carryover of infectious droppings from brood to brood.

However, farmers cannot expect to achieve complete control through sanitation, ARS research veterinarian R. L. Witter cautions. There may be sources of infection other than saliva and droppings, and these must be identified and eliminated.

Like other forms of avian leukosis, Marek's disease is a cancer-like infection; it attacks the nervous system, viscera, eyes, muscles, and skin.

Witter, who leads research on Marek's disease at the ARS Regional Poultry Research Laboratory, East Lansing, Mich., says previous knowledge about the spread of the disease was sketchy since its cause had been discovered only recently.

In their research on the spread of Marek's disease, scientists started with birds known to be infected as shown by laboratory tests and the typical symptoms—lesions coupled with lameness. Researchers rinsed the mouths of these infected birds and took fecal samples.

Then they transferred both rinsings and feces with syringes into the abdomens of healthy recipients. Every bird so treated came down with Marek's disease, and more than 75 percent died.

In a second trial, the scientists placed healthy birds raised in isolation units on litter or exposed them to droppings from infected birds. All birds so exposed came down with the disease. Birds kept under similar conditions but on sanitized litter stayed free from the disease.

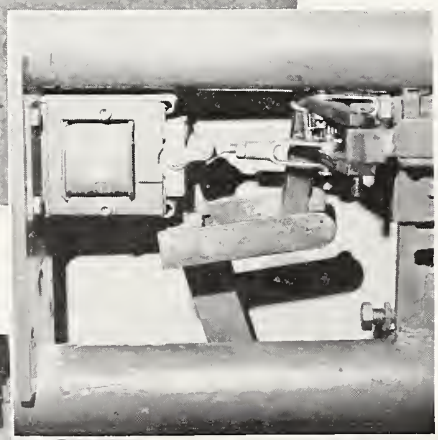
In a third trial, the poultry researchers placed saliva and feces from infected birds into the noses of healthy birds and transferred swabs of saliva from mouth to mouth. Fewer birds came down with Marek's disease with this treatment than with injections into the abdomen, illustrating the fact that the mechanism of natural transmission of Marek's disease is not yet completely understood.

In their continuing research, Witter and his coworkers will try to learn more about how Marek's disease spreads and how the disease organisms survive in transmission from infected to healthy chickens.

The scientists recommend this standard five-point cleanup program for Marek's disease: 1. Remove all equipment and clean and sanitize it outside the house. 2. Remove all litter, preferably to a place off the farm. 3. Wash house and curtains inside and out with pressurized hose. 4. Scrape and sweep floors, sills, and other surfaces. 5. Spray inside, including upper part of house and curtains, with strongest permissible concentration of disinfectant.■

Unmanned gate opens to let sheep out of auction ring. (Photo No. ST–733–8). Buck Sumners, a livestock buyer (below), pushes button to open livestock gate (Photo No. ST–733–4). Electric latch mechanisms (below, right) provide rugged, slam-proof operation. The latch can also be operated manually by lever in the background. (Photo No. ST–733–2).

Livestock Move Faster.. Fewer Workers Needed with EXPERIMENTAL GATES



ONE MAN PUSHING buttons that open and close electric gates can move livestock in and out of a sales ring as fast as they can be auctioned. And he can move as many head of livestock as four or more workers operating gates manually.

Designed by agricultural engineers H. F. Mayes of ARS and J.S. McKibben and H. H. Obermeyer of the University of Missouri, Columbia, the experimental gates could be used at livestock auctions, stockyards, and other locations to move large numbers of livestock in a short time.

When tested at a livestock sale barn at Mexico, Mo., the gates performed well in almost nonstop operation for

up to 7 hours daily and withstood 100,000 openings and closings during 10 months.

The gates could be built for $2,000 to $3,000 and operated for 40 cents or less per week. Most parts are available at construction and hardware stores, and special fittings are easily made at any machine shop.

The experimental gates have several advantages over mechanically operated gates now in use. Electric latch mechanisms permit the gates to swing in or out in a full 180-degree arc, providing greater versatility than gates that open in only a 90-degree arc. This feature permits both animals and equipment to move through the door with the gate opening away from instead of toward oncoming traffic.

Weighing 70 to 80 pounds, the gates are sturdy enough to withstand repeated banging against the latch and the repeated banging of crowding animals. Since workers are not needed to tend the gates, livestock are less likely to hesitate and bunch up as sometimes happens when they must pass by a gate tender. Elimination of such bottlenecks, which slow down an auction, minimizes risks of animals kicking or goring each other or workers.

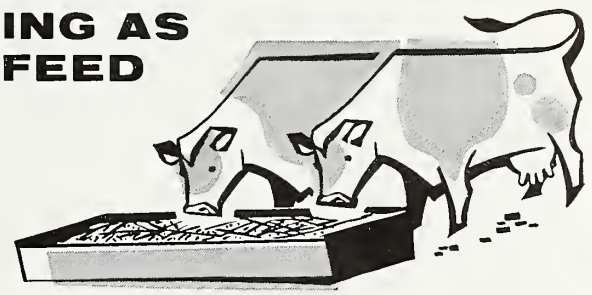
If a malfunction or power failure occurs, the gates can be opened manually from either side—a safety feature and a convenience during cleanup when switches are unmanned.

Both the motor that opens and shuts the gate and the electric latch are controlled by the same switch. A ½-horsepower motor moves the gates fast enough for efficient auctioning, but not so fast that the gates will catch and injure livestock passing through.

Engineering specifications for the new electric gates may be obtained from ARS. Send requests to the Handling and Facilities Research Branch, Transportation and Facilities Research Division, ARS, Federal Center Bldg., Hyattsville, Md., 20782. Please include your zipcode.■

When Treated With Forric Acid . . .

UNWILTED SILAGE PROMISING AS CATTLE FEED



TREATING UNWILTED hay-crop silage with formic acid, a common industrial chemical, may allow farmers to bypass wilting.

And dairy heifers fed the treated silage in preliminary trials gained more while eating less than heifers fed hay or unwilted, untreated silage.

Based on the results of these trials, ARS dairy cattle nutritionist D. R. Waldo considers formic acid extremely promising as a chemical additive for silage. "It appears to overcome the problems of quality and palatability, even though the higher seepage losses of unwilted silage remain," the scientist says.

Farmers risk bad weather to wilt forage in the field mainly because cattle will not eat enough unwilted silage for proper nutrition. But Waldo found previously that unwilted silage provides the nutrients cattle need even though they don't like it. (AGR RES., May 1966, p. 5.)

In his recent tests at Beltsville, Md., Waldo added 1 pound of undiluted formic acid to every 200 pounds of orchardgrass as it was blown into a silo and fed this treated, unwilted silage to a group of heifers. As a check, he fed orchardgrass hay cut from the same field to a second group.

The silage-fed heifers, by chance, started out at a lighter average weight than hay-fed animals—611 pounds compared to 633 pounds, but the 22-pound gap was rapidly narrowed.

Heifers fed unwilted silage treated with formic acid ate 27 percent less forage per day, on a dry-matter basis, than those fed hay. They ate 5 percent less unwilted, treated silage than heifers fed unwilted, untreated silage in Waldo's previous trials.

At the end of a 99-day feeding period, the group fed treated silage weighed 789 pounds and the hay-fed group, 796 pounds—a 9-percent higher average daily gain for the group on treated silage.

To determine why silage-fed heifers gained more than hay-fed, Waldo fed unwilted, treated silage to another group of heifers. He found that the digestibility of the energy in treated silage was 17 percent greater than in hay from the same field. So, although they ate less solids, the silage-fed heifers received almost exactly the same amount of digestible energy from a meal as the hay-fed animals.

In laboratory tests, Waldo also found that treated, unwilted silage was preserved better than untreated, unwilted silage.

In future research the nutritionist hopes to learn why silage-fed heifers gained more than hay-fed animals. Although the difference may be chance, Waldo considers it possible that the heifers used the digestible energy in treated silage more efficiently for growth.■

Lynn Tilley, left, from Pennsylvania State Univ., eats part of her starch ration as a wafer; Sandra Crispin, Univ. of Nebraska, eats an equal amount of carbohydrate as sucrose, a sugar mixed with fat into a sauce. (Photo No. BN–27009)

College Students Control Diets to Learn . . .

ROLE OF CARBOHYDRATES IN FOOD

TWENTY COLLEGE students voluntarily controlled their diets and helped analyze their own body reactions during the past two summers in ARS studies to discover the role of carbohydrates in nutrition.

This role is important because of a major shift in American eating habits during the last half century.

Between 1909 and 1964, the proportion of starch-containing foods such as flour and potatoes decreased from 62 to 42 percent of the average American's total carbohydrate intake. Meanwhile, sugars and other sweeteners in the diet increased from 22 to 36 percent of the total carbohydrate intake.

Until recently, scientists regarded all carbohydrates as nutritionally similar sources of calories. But research with laboratory animals now indicates that different carbohydrates produce different effects in the body, depending on the heredity of the eater and the rest of his diet.

The type of carbohydrate can affect fat metabolism, for example, and might influence the progress of degenerative diseases, such as hardening of the arteries, that were previously linked mainly with fats in the diet.

In the ARS tests, student volunteers were divided into teams, equalized for height and weight. One team ate a high-starch diet for 30 days, and a high-sugar diet the next 30 days. The second team did the reverse. Volunteers helped analyze their own blood and saliva samples to check the effect of their controlled dieting.

Women students, who were studied first, had less fatty acids in their blood on the sugar diet. The lower fatty-acid level may mean that these fat-forming substances were taken out of the blood and stored in body cells. The levels of certain enzyme catalysts important in metabolism also varied with the type of carbohydrate.

Cholesterol level in the blood of women on high-starch and high-sugar diets did not differ materially. Earlier studies of men by other researchers apparently indicated that high-sugar diets go along with higher blood cholesterol levels. Data on men in the ARS study has not yet been processed.

During the studies, the students lived in student quarters at the University of Maryland, a few miles from the ARS human nutrition research laboratory at Beltsville, Md. Meals were prepared at the quarters by other summer workers.

Diets were fairly varied and included meat, vegetables, fruits, and juices. Wheat starch. served in baked biscuits and wafers. furnished 84 percent of the carbohydrates in one diet. Sucrose, a sugar which furnished the same amount of carbohydrate in the other diet, was served in hard sauce patties.■

W. E. Jacobson, a microbiology major at Cornell University, measures reagent for nitrogen analysis. (Photo No. ST–1420–21)

Coeds were selected for their interest in the diet project and for balance in height and weight. (Photo No. BN–27011)

More FLAVOR for Maple Sirup

To strengthen the maple sirup industry, ARS has developed a new way to intensify the flavor in sirup for home and industry.

Cheaper and more efficient than the previously used batch process developed by ARS in 1951, the new continuous process can be precisely controlled. It can be used for concentrated maple products and to produce different types of sirups rich in maple flavor—of special value to manufacturers of blended table sirups.

Now being used commercially, the continuous process was developed at the ARS eastern utilization research laboratory, Philadelphia, as part of continuing studies to modernize the sirup industry and to encourage more use of untapped maple trees. Only 5 percent of U.S. maple trees are now tapped, and most of the sirup used in this country for blended table sirups is imported from Canada.

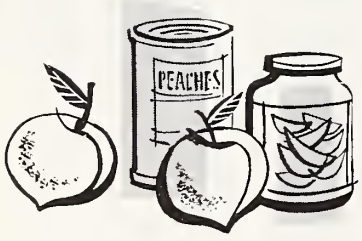
Maple sap as it comes from the tree has no maple flavor and no color. The characteristic flavor and amber color result from reactions that occur when the sap is evaporated to sirup by boiling.

But in conventional sirup making, not enough heat is applied to cause all possible flavor reactions. Thus, the full flavor potential of the sirup is not realized.

In the new ARS process, sap that has been boiled to sirup as usual is pumped continuously through a heat exchanger—a tube heated with high-pressure steam—to intensify the flavor. The sirup does not boil, so no water is lost by evaporation.

Changing the pressure of the steam adjusts the temperature of the sirup, and varying the pumping rate controls the heating periods.

In the older process, sirup was simply boiled for the time required for the desired flavor intensification. Then it was restored to the proper density by adding the water lost by evaporation. In this method it was hard to get the right temperatures for various end products. Also, since it was a batch process, it was slower and tied up machinery longer than the new method.■



Peach Processing Industry for EAST

The peach processing industry has expanded eastward.

More than a million trees of five new clingstone varieties were commercially planted in Eastern United States and Canada during the past 2 years. These varieties, called Babygolds, are especially adapted both to the East and to processing.

Until recently, eastern growers have depended almost entirely on selling their peaches fresh. Processing peaches were largely grown in the West.

The five Babygold varieties, developed by the New Jersey Agricultural Experiment Station at Rutgers, were evaluated for processing in a screening program conducted by the station under an ARS contract—part of utilization research to seek new processing outlets for fruits and vegetables.

Tests indicate that Babygolds have superior flavor and exceptionally good processing quality, especially for making babyfood puree. And the Babygold peaches are nonmelting—they remain firm at the peak of their flavor development.

The five varieties have a range of ripening dates. Harvesting and processing can be evenly spread over a 3½-week period if all five varieties are grown.

In their screening program, the scientists also found 10 freestone-type peach varieties and 2 nectarine varieties with potential for processing.

Babygold peach trees are available to area growers through some commercial nurseries. Since they are strictly processing varieties, however, a grower should have a contract with a processor before making extensive plantings.■

Research Leads to Tasty Holiday TURKEYS

WITH THE HELP of ARS food scientists, homemakers can serve tastier turkeys during the coming holiday season.

They can save time and work, and can guard against spoilage, in preparing and cooking their birds.

Summarized here are results of recent ARS research on thawing, roasting, and spoilage of turkeys.

THAWING:

Homemakers can cut thawing time for large frozen turkeys from the common 3 days in the refrigerator to 6 to 8 hours in cool water. Submerge turkeys inside a watertight plastic bag placed in a pan of cool water, ARS food specialists recommend.

To thaw frozen turkeys at room temperature, follow the instructions on the package exactly to minimize problems with bacteria. Leave the turkey in the bag at room temperature only for the minimum time needed for thawing. Then refrigerate or cook immediately.

Or the lengthy thawing job can be omitted altogether. Turkeys that are stuffed before being frozen should *never* be thawed before cooking. Turkeys frozen without stuffing and with neck and giblets removed from the body cavity can also be placed in the oven directly from the freezer—and need only slightly longer cooking time.

ROASTING:

Tender modern turkeys need not cook as long as old-fashioned turkeys.

Reports from ARS researchers and cooperators at Purdue University show that turkey is tastiest when roasted in an open pan at 325 degrees F. until inner thigh temperature reaches 180 to 185 degrees.

Compared to roasting at 200 degrees and 450 degrees, roasting at 325 degrees showed several advantages. Meat was ahead in flavor, tenderness, juiciness, and yield. Breast meat cooked evenly and thigh meat tenderized properly.

Even though 325 degrees is a better temperature, researchers found that wrapping the bird with aluminum foil or covering the roaster helped turkeys cook more evenly at 200 or 450 degrees F.

Food specialists say that a 12- to 16-pound turkey roasted at 325 degrees F. will be done in 4½ to 5½ hours. Terminating the roasting then keeps meat from drying out and falling from the bone. A meat thermometer inserted into the inner thigh muscle indicates the turkey is done when the temperature is 180 to 185 degrees F.

When a thermometer isn't available, use a rule of thumb that says turkeys are done if the fleshy part of the drumstick and thigh feels soft. At that time the drumstick moves up and down easily when jiggled or breaks at the joint.

STUFFING:

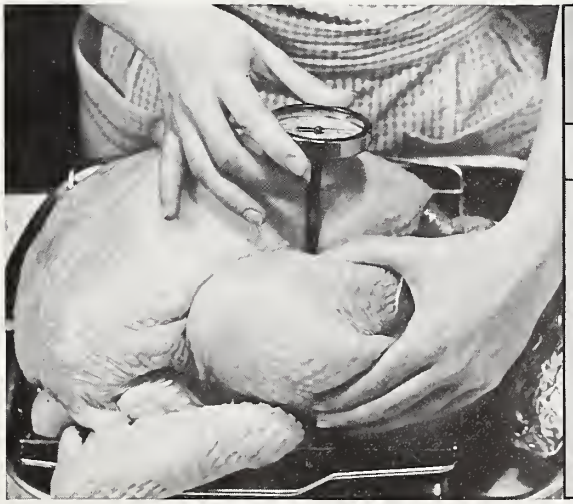
Cooking the stuffing separately saves time. It can be prepared while the turkey is cooking, and can be roasted in the same oven during the last hour that the turkey cooks. Turkey roasted without stuffing tastes as good as stuffed turkey, ARS trials show. If you like moist stuffing, baste it occasionally with pan drippings from the roasting turkey.

SPOILAGE:

Throughout the preparation of turkey, home cooks should guard against spoilage. A lapse in attention can not only damage the quality of the meat but can also cause food poisoning. Bacteria that cause spoilage thrive in temperatures ranging from 45 to 120 degrees F. Dangerous buildup can be avoided if the turkey is not kept in that temperature range for more than 3 to 4 hours.

New ideas on turkey cooking can be found in the ARS publication "Poultry in Family Meals." Request HG–110 from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Cost is 15 cents per copy. Please include your zipcode when ordering.■

A meat thermometer inserted into the inner thigh muscle registers 180 to 185 degrees F. when bird is done. (Photo No. BN–23509) Chart below shows approximate roasting times at oven temperature 325 degrees F.



READY-TO-COOK WEIGHT	APPROX. ROASTING TIME
POUNDS	HOURS
6 to 8	3 to 3½
8 to 12	3½ to 4½
12 to 16	4½ to 5½
16 to 20	5½ to 6½
20 to 24	6½ to 7

Rust-Resistant Oats Possible

An oat variety used only in breeding research now offers a source of resistance to stem rust—one of the most costly diseases attacking oat crops.

The variety, C.I. 3034, is a poor agronomic type not grown commercially but used to establish desirable characteristics in commercial varieties. In recent ARS tests at St. Paul, Minn., C.I. 3034 resisted 28 of the 35 races of stem rust known to occur in North America, including 6AF and 6AFH, 2 of the most dangerous. The remaining seven races were not available for testing. The Minnesota Agricultural Experiment Station cooperated in the tests.

Although C.I. 3034 is one of the best sources of stem rust resistance found in recent years, this resistance exists only in adult plants. ARS plant pathologists Mengistu Hulluka and B. J. Roberts explain. Seedlings resist only 13 races of stem rust. The scientists do not yet understand how this resistance functions, but believe that the resistance C.I. 3034 exhibits is different from that usually encountered.

Hulluka and Roberts also believe that through the discovery of resistance to 6AF and 6AFH, new commercial oat varieties resistant to all known races of stem rust can be developed.

Race 6AF became the most prevalent in the Central States in 1965. Most of the Nation's oat crop—82 percent of it—is grown in this region. Virtually all varieties grown commercially are attacked by 6AF. Race 6AFH, a new race identified in 1965, is even more virulent and attacks the few cultivated varieties resistant to 6AF.

From 1951 through 1960, only four diseases—crown rust, barley yellow dwarf virus, blast and root rot—caused greater losses to commercial oat growers than stem rust.■

New Cotton Strains Tolerate Wilt

Cotton growers in the West may soon raise varieties developed from two new breeding strains—one more tolerant to the disease verticillium wilt than any cotton now grown; the other combining early maturity with wilt tolerance.

ARS plant breeder J. R. Cotton developed the new strains, called Acala 8229 and NM 9608, in cooperation with the New Mexico Agricultural Experiment Station at University Park. Seed is now being released to commercial breeders who will use it to develop varieties which will be available to growers within a few years.

Verticillium wilt is one of the worst diseases of cotton grown in the West. The soil-borne fungus disease attacks leaves of the cotton plant, cutting yield and fiber quality. There are no resistant strains or varieties, but growers avoid loss to some extent by raising wilt-tolerant cotton.

Acala 8229 has more tolerance to verticillium wilt than Acala 1517V, the best wilt-tolerant strain now grown commercially. On soils severely infested with verticillium wilt, Acala 8229 consistently out-yielded Acala 1517V in Cotton's tests. Acala 1517V produces high-quality fiber with good spinning properties, and the new strain is equally good.

While slightly less tolerant to verticillium wilt than Acala 1517V, NM 9608 is more tolerant than early varieties now grown commercially. Growers consider early maturity an advantage in marketing their cotton.

In the tests at University Park, NM 9608 matured about 2 weeks before the Acala strains. Yield was about the same as Acala 1517V. In fiber quality and spinning properties, NM 9608 ranked lower than the Acala strains but higher than most other varieties.■

New Standard Terms Define STAGES OF FRUIT GROWTH

THERE'S MORE TO checking ripeness in fruit than pinching or squeezing. What feels ripe to one person may feel "green" to the next.

Even terms used by scientists to describe degrees of ripeness in fruit, such as "early maturity," do not necessarily mean the same thing to all who use them.

Growers and researchers can now use a set of standard terms developed by ARS biochemist W. A. Gortner and other scientists at the Pineapple Research Institute, Honolulu, Hawaii, to identify stages of fruit growth.

Gortner and his coworkers determined the biochemical changes that take place at various stages of the development of pineapples. Since all fruits undergo such changes, the scientists used their findings to develop the standard terms.

These terms, Gortner points out, can be used for such purposes as telling growers precisely when to apply protective chemical sprays or to harvest for certain markets. Simple chemical tests can verify the fact that fruit has reached a certain stage of growth.

The new definitions draw a major distinction between two broad categories: *development* and *senescence*. During *development*, fruit tissue forms, takes its shape, and undergoes formative chemical processes. *Senescence* starts when all growth has ceased and the biochemical processes of aging replace the formative changes of ripening.

Development is divided into two major stages, *prematuration* and *maturation*. During *prematuration* fruit starts forming, and cells usually enlarge rapidly. This stage generally includes at least half of the time between blossoming and harvest..

During *maturation*, fruit takes its characteristic shape and size. Most maturation processes take place while fruit is still attached to the plant.

The new standards also specifically define *ripening*, the last stage of maturation. Fruit attains its characteristic color and odor during this time, and distinct biochemical changes occur. In pineapple, for example, there are increases in yellow pigment, in the volatile esters that contribute to aroma, and in acidity; each of which can be tested chemically.

Scientists now know fairly well which biochemical changes mark the stages of growth of apples, peaches, oranges, and mangoes. They expect to learn more about these fruits, and to determine the changes that occur in other fruits, so that all may be classified by Gortner's system.

In some cases, related research by ARS and other institutions has yielded information that can be used in classifying fruit growth. ARS human nutritionists, for example, have learned about chemical changes in peaches, strawberries, and raspberries during research on the eating quality of these fruits.■

Two ragwort seed flies are seen on the tansy ragwort. (Photo No. PN–1450)

Second European Insect Introduced for . . .

BIOLOGICAL CONTROL of Range Weed

A SECOND INSECT native to Europe has been loosed in California and Oregon against the toxic range weed tansy ragwort.

The ragwort seed fly (*Hylemya senciella*) was introduced this year to bolster biological control efforts begun in 1959 with the introduction of the cinnabar moths into California (AGR. RES., January 1960, p. 12).

The cinnabar moth—though a dedicated feeder on ragwort—has been unable to keep pace with the weed's rapid spread. The seed fly may tip the balance against the weed. Although tansy ragwort will probably not be completely eradicated, scientists believe that the two-pronged attack of the moth and the seed fly will weaken the weed's growth and reproduction enough to give desirable grasses a competitive advantage.

Chemicals can be used to control tansy ragwort. However, areas of infestation are so large, and in many cases so inaccessible, that spraying doesn't pay.

To make sure that the seed fly would eat only tansy ragwort (*Senecio jacobaeae*), ARS research entomologists K. E. Frick and L. A. Andres began a 3-year test in 1963 at the Parasite Introduction Laboratories in Paris and Rome, and in the United States at Albany, Calif. The University of California and Oregon State University cooperated in the research at Albany.

In repeated tests, the seed fly did not eat crops related to ragwort such as safflower, chicory, endive, and head lettuce. The experiments also indicate that the seed fly probably cannot reproduce on plants other than ragwort. Flies laid small numbers of eggs on four other species of *Senecio* but even when larvae emerged, they survived only briefly.

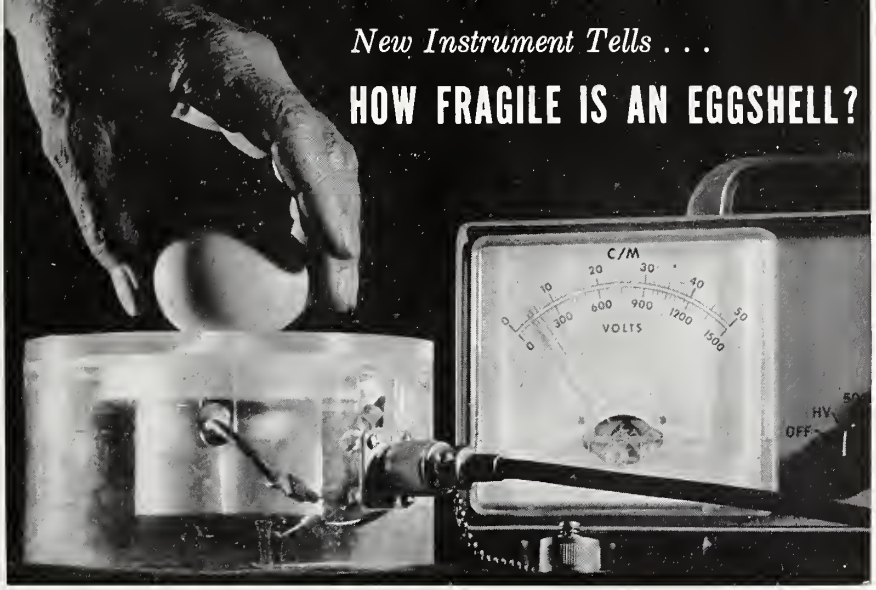
At first, the scientists used adult flies from the blooms of ragwort plants growing near Paris. Those released in the Pacific Coast States were descended from a shipment of 3,400 flies sent to Albany from Rome.

This year, 1,316 females and 637 males were released in California, and 1,408 females and 660 males were released in Oregon where ragwort growth is heaviest. Frick and Andres expect the flies to reproduce rapidly. If reproduction is unsatisfactory, approximately 9,000 more flies will be released next year.

Although both the cinnabar moth and the seed fly feed on the ragwort plant, their feeding habits are different. The advantage of using both in efforts to biologically control the weed results from their different styles of attack.

The seed fly female lays its eggs in the flower bud of the plant near the developing seed. The emerging larvae consume many seeds and damage others, which greatly reduces the plant's reproductive capacity.

Cinnabar moth females, however, lay their eggs on the underside of the ragwort leaves. Emerging larvae feed on the foliage and young buds of the plant. Continued defoliation destroys the seed heads and greatly depletes the plant's food reserve—usually causing the weed to die.■



The backscatter gage in action. The instrument at right is the beta counter which records the energy particles that bounce back. (Photo No. ST–1376–7)

HOW FRAGILE IS an eggshell? ARS agricultural engineer P. E. James has developed an instrument that gives the answer in 15 seconds—without breaking the shell.

When adapted to commercial use, James says, the instrument would help poultry breeders select lines of layers that produce better quality eggshells.

This, in turn, would aid consumers, annoyed by eggs that break too easily; and egg producers, packers, and marketers, for whom broken eggs mean lost dollars. In 1965, about 3 percent of all eggs produced were broken before they reached consumers. Eggs that resist breakage could also be better adapted to mechanical handling.

James designed and built the instrument at Beltsville, Md., in cooperation with the Atomic Energy Commission. It is still experimental, and the engineer is working now to try to shorten the time needed for measuring shell thickness.

The instrument is called a backscatter gage. It analyzes fragility by firing beta energy particles at an eggshell and counting the particles that bounce back. If the shell is thick, most of the energy bounces back, resulting in a large number of counts on a Geiger-Mueller counter; if the shell is thin, little energy is reflected.

The experimental instrument consists of: (1) A beta-energy radiation emitter which contains ruthenium-rodium-106 isotope, (2) a ringshaped Geiger-Mueller tube on which the energy bounces back, (3) tube holder and metal grounding plate, (4) spacer ring to hold the tube in place, and (5) a counter to record the energy that bounces back.■

ARS Survey Tells What Families Spend For Food

The average American family of 3.3 persons ate $35 worth of food per week during the spring of 1965—a 17-percent increase since 1955, an ARS survey shows.

The 17 percent increase in the family food bill—which amounts to $5—includes a 13-percent rise in food prices since the last national survey in 1955. It also includes an increase in food purchases by farm families and a decrease in their home-produced food. In 1955, farm families produced 41 percent of their food at home. Last year, they produced 31 percent.

Of the $35, $29 was for food used at home including $2 for the market value of home-produced food, federally donated food, and food received as gifts or pay. Meals and snacks away from home averaged $6 per family per week.

The survey, by Faith Clark, director of ARS consumer and food economics research, food economist S. F. Adelson, and statistician Evelyn Grossman, will help guide farm and food policies, serve as a basis for nutrition education programs, and benefit economic and marketing research on demand for farm products.

Approximately 7,500 families of all sizes in cities, rural nonfarm and farm areas in the Northeastern, Northwestern, Southern, and Western regions of the country, were surveyed, thus giving a nationwide picture.

Comparisons between groups surveyed show that in 1965 urban and farm households used food worth $36 per week while rural nonfarm households used $33 worth. Regional variations ranged from $39 in the Northeast to $31 in the South.

Average families near the top of the income ladder had food bills more than twice as high as those at the bottom. Families with incomes above $10,000 used food worth $54 per week; those earning under $3,000 used $20 worth.

Additional survey reports giving further details about family food consumption and dietary levels during different seasons of the year will be published beginning in 1967.■

UNITED STATES GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS, WASHINGTON, D.C. 20402

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AGRISEARCH NOTES

Plant Chemical Deforms Lambs

The chemical veratramine, found in some plants of the *Veratrum* species in the lily family, is now known to cause deformed legs in lambs.

The discovery, by ARS chemist R. F. Keeler and research veterinarian Wayne Binns at Logan, Utah, moves scientists closer to learning how toxic chemicals eaten by pregnant ewes cause malformations.

Of 16 pregnant ewes Keeler and Binns dosed with veratramine, 6 aborted or produced abnormal lambs. Abnormalities included slightly bowed front legs, loose leg joints, and no muscle control. Except for those with bowed legs, abnormal lambs improved within 3 weeks after birth.

Because the ewes received veratramine before the leg buds formed in the lamb embryos, Keeler and Binns believe the chemical affects the central nervous system. Their theory is strengthened by the fact that, in most cases, lambs recovered quickly from the deformities, suggesting that alternate nerve systems for muscle control were developed to replace those damaged by veratramine.

In earlier studies, Keeler and Binns had induced congenital "monkey-faced" lambs repeatedly by giving ewes chemicals similar to veratramine. These included alkaloid V, a chemical in the poisonous range weed false hellebore of the *Veratrum* species. In single instances, alkaloid X and veratrosine caused deformities. Keeler and Binns found that these deformities occurred only when ewes were dosed on the 14th day of gestation (AGR. RES. August 1964, p. 13, and January 1966, p. 15). Therefore the researchers fed veratramine on the 13th and 14 days of gestation.

Chemicals similar to veratramine were once extracted from lily family plants and used to treat humans for neuralgia, arthritis, and some cardiac conditions.■

Veratramine fed to ewe caused looseness of knees and hock joints in this lamb. (Photo No. PN–1451)

Asphalt Catches Desert Rainfall

Add asphalt to the list of modern spray-on marvels.

ARS scientists at Tempe, Ariz., are spraying it on patches of desert land. Thus waterproofed, the paved areas serve as water harvesting mats, catching the scant rainfall of the region and funneling it into storage reservoirs where it can be used by livestock.

In recent years, catchments have been built from concrete, sheet metal, and other conventional materials, costing $2 to $3 per square yard.

But with asphalt, hydraulic engineer L. E. Myers and agricultural engineer G. W. Frasier paved six catchment sites for an average cost of 75 cents per square yard. And on plots larger than the 100-by-100-foot test sites, the cost per square yard would be much less, Myers says.

During 2 years, virtually all of the rainfall runoff from the mats was caught.

Cracking and curling of the asphalt has been a recurrent problem. Researchers are counteracting this by spraying two coats of asphalt on the soil—the first, an emulsion that binds soil particles together to a depth of ½ inch; the second, a waterproofing agent that adheres snugly to the first coat.

Before asphalt is applied, the sites are smoothed and graded, and sterilant is applied to prevent weeds from breaking through the asphalt.

The scientists successfully paved several types of soil, including gravel, loam, clay, and volcanic cinders, but they found that the asphalt materials must be selected to fit the soil type.

Runoff water from the asphalt was somewhat discolored, but livestock drank it readily and apparently were not affected. The researchers found that a coat of inexpensive aluminum paint applied to the pavements improved the quality of runoff water.■

U.S. GOVERNMENT PRINTING OFFICE:1966